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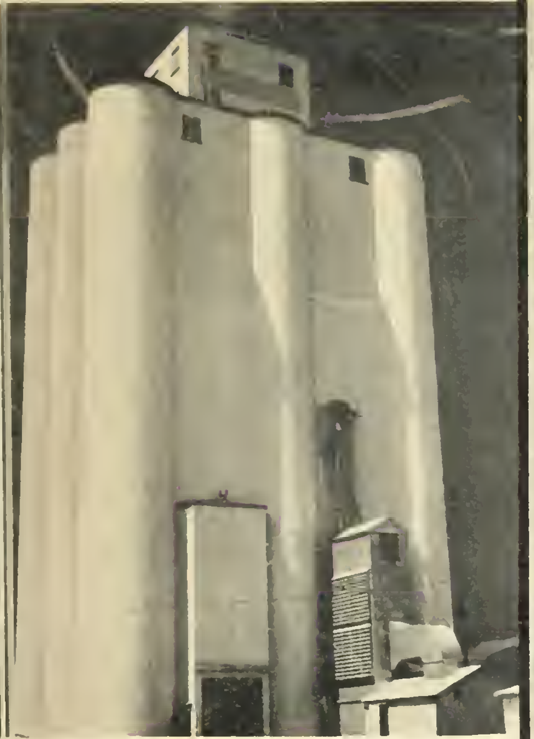

# NEW COUNTRY ELEVATORS

## influence of size and volume on operating costs

*By Thomas E. Hall*

FSC Circular 10
JUNE 1955

U. S. DEPARTMENT OF AGRICULTURE
FARMER COOPERATIVE SERVICE
WASHINGTON 25, D. C.

The Farmer Cooperative Service conducts research studies and service activities of assistance to farmers in connection with cooperatives marketing farm products, purchasing farm supplies, and supplying business services. The work of the Service relates to problems of management, organization, policies, financing, merchandising, quality, costs, efficiency, and membership.

The Service publishes the results of the studies; confers and advises with officials of farmers' cooperatives; and works with educational agencies, cooperatives, and others in the dissemination of information on cooperative principles and practices.

**JOSEPH G. KNAPP,**
***Administrator***
***Farmer Cooperative Service***
***U. S. Department of Agriculture***

This study was conducted under authority of the Agricultural Marketing Act of 1946 (RMA, Title II).

**FCS Circular 10** **June 1955**

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# NEW COUNTRY ELEVATORS

## influence of size and volume on operating costs

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By Thomas E. Hall
Grain Branch, Marketing Division

DO YOU own and operate an old country elevator in the Hard Winter Wheat Belt? Many now operating, particularly in the northern half of the region, are 30 years or more old.

Is your elevator too small to accommodate the average annual volume of grain needing elevator storage from its trade territory? Better farm-to-market roads, combine harvesters, and improved transportation equipment enable patrons to store most of their wheat in elevators rather than on farms.

Are your management and labor costs high on a per bushel basis? Higher salaries and wages necessary for present-day elevator personnel have to be offset by greater volume and more efficient operation.

Are the grain shrinkage and deterioration in quality that occur because of less than adequate facilities making your operating costs excessive?

***If your answer to these questions is YES—, and if you are considering building a new elevator, or adding new equipment or sideline commodities—this circular is intended to help you.***

Members of the Grain Branch, Farmer Cooperative Service, recently made a study of local elevator operations in the Hard Winter Wheat Belt. Using six different elevator models, we measured the influence of size and volume on operating costs.[1] In five models we considered what effect different sideline volumes would have on costs of operation.

The elevator models we chose for study were as follows:

1. An old elevator with 20,000-bushel capacity and $30,000 annual sideline volume, all handled from one warehouse, and the same elevator with additional bulk petroleum facilities that increased sideline volume to $145,000.
2. A new 20,000-bushel elevator under conditions of both $30,000 and $145,000 sideline volumes.
3. A new 100,000-bushel elevator

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[1] The concrete elevator design and equipment specifications used in the study were furnished by Chalmers and Borton, Contractors, Hutchinson, Kans. Other contractors building in the region provide similar basic plans and specifications.

operated in conjunction with the old 20,000-bushel plant under both $30,000 and $145,000 sideline volumes.

4. A new 200,000-bushel elevator added to the old 20,000-bushel plant under both $30,000 and $145,000 sideline volumes.

5. A new 300,000-bushel elevator added to the old 20,000-bushel plant under both $30,000 and $145,000 sideline volumes.

6. The same new 200,000-bushel elevator mentioned as number 4 with an added 400,000-bushel storage capacity—making a new 600,000-bushel model—plus the old 20,000-bushel plant and sideline volume of $145,000 only. (See figures 1 to 4 in appendix.)

We considered all expenses of operation including:

1. Fixed costs—due chiefly to plant and equipment—such as depreciation, taxes, insurance, interest, bonds and licenses, and railroad lease; and

2. Variable costs—resulting from volume of grain handled and decisions of management—such as salaries and wages, social security taxes, workmen's compensation, power, lights, heat, water, telephone and telegraph, repair and maintenance, auditing, advertising, meeting and membership relations, subscriptions and dues, legal advice, directors' fees, travel, bad debts, office supplies, fumigants, shrinkage, and quality deterioration.

Our study enabled us to set up guides by which you can more easily project per bushel costs at different volume levels in the new elevator you may wish to build. It points up specific unit cost-volume relationships according to major functions of your elevator business—merchandising or handling, storage, and sideline operations.

## What We Learned

OUR experience in the study indicates the greatest need for modernizing is in regions where one crop comprises most elevator volume and in warmer climates where deterioration in stored grain is a more critical prob-

Old elevators were built to meet situations in which this type farm equipment was used.

The combine has replaced older machines on most farms and made elevator modernization necessary.

lem. These conditions caused the largest number of elevators built within the past few years to be located in the southern half of the Hard Winter Wheat Belt. They also explain why the Corn Belt has only recently become interested in new facilities.

After carefully analyzing the major influences on per bushel costs of operating different size elevators with different volume and sideline levels, here are our chief findings:

## On Merchandising or Handling

***FINDING—When a large country elevator has sufficient volume to operate at near its maximum practical volume level, it has an important competitive advantage over smaller elevators.***

At the maximum practical volume level, costs for merchandising or handling grain, including shrinkage and quality deterioration, range from 5.08 cents a bushel in the new 20,000-bushel model down to 2.63 cents a bushel in the 600,000-bushel model. This is on the basis of a 250,000-bushel annual volume in the 20,000-bushel model and 1.5 million bushels in the 600,000-bushel model (Appendix table 1).

***The larger the elevator the higher the unit costs at the same volume, however.*** This is because of higher fixed costs in the larger models.

For example, at a 200,000-bushel annual volume, the new 20,000-bushel elevator has per bushel costs of 5.32 cents. At the same volume, per bushel costs are 10.47 cents in the new 600,000-bushel elevator (Table 1).

The curved lines in appendix figure 5 show these costs graphically for the six elevator models. By intersecting the curved line with a horizontal line at the unit cost of operating the new 20,000-bushel elevator at a 250,000-bushel annual volume—5.08 cents—you can readily see what additional volume will be necessary to operate the larger elevators at the same per unit cost. It takes 500,000 bushels, or double the annual volume of the small model, to operate the 600,000-bushel model at the 5.08-cent unit cost. The old 20,000-bushel elevator requires only a 185,000-bushel volume to operate at the same cost.

***FINDING—To operate at the same per bushel costs, the additional volume required for each 100,000 bushels of elevator capacity decreases as the elevator size increases*** (Appendix table 2). This general relationship will hold whether the horizontal line in figure 5 is drawn at the 5.08-cent level or at some other lower unit cost level.

***FINDING — The 600,000-bushel model can merchandise or handle grain at one-third its maximum practical volume and still be competitive with the new 20,000-bushel model merchandising or handling its maximum volume, or 250,000 bushels annually*** (Appendix table 3).

Table 3 also indicates the advantage of an elevator located in a trade territory that will give it an average of a million bushels or more annually over competing elevators with small trade territories and correspondingly small annual volume merchandised or handled.

Furthermore, these data point to the advantage of adequate siding for spotting and loading cars, and fast receiving and loading out equipment. Shipping wheat on to subterminal or terminal storage rather than storing it in country elevators also adds to volume merchandised or handled. Thus, lower unit costs result, regardless of elevator size, for the merchandising or handling function.

***SUGGESTION***—If you are interested in minimizing grain merchandising or handling costs, build as large an elevator as you need to handle your expected average volume but no larger. You should add elevator storage capacity only when what appear to be average conditions make it impossible for you to ship grain, including that for terminal storage, as fast as it is received during the harvest season.

Provide equipment and railroad siding sufficient to ship your grain as fast as terminal elevator capacity and rail facilities will permit. Thus you will gain lower unit costs from a higher volume merchandised or handled in relation to the capacity of your local elevator.

## On Storage

No elevator can use all its capacity for storing grain. Some space must be reserved for grain owned by the elevator and for turning stored stocks. In the study models, capacity used for storage beyond the harvest season was as follows: In both 20,000-bushel models—15,000 bushels; in the new 100,000-bushel plus the old 20,000-bushel model—90,000 bushels; in the new 200,000-bushel plus the old 20,000-bushel model—180,000 bushels; in the new 300,000-bushel plus the old 20,000-bushel model—270,000 bushels; and in the 600,000-bushel model—540,000 bushels.

Our findings are based mainly on the models with new elevators and deal with costs in terms of per bushel capacity used.

***FINDING—Annual storage costs per bushel of capacity, when all available capacity is used, are less than half as high in the 600,000-bushel model as in the new 20,000-bushel model—5.14 cents compared with 11.44 cents*** (Table 4).

***But storage unit costs at identical amounts of capacity used are considerably higher as the size of the elevator increases.*** For example, using 90,000 bushels of elevator capacity, costs per bushel of capacity used are 7.32 cents, 10.92 cents, and 14.46 cents for the 100,000-bushel, 200,000-bushel, and 300,000-bushel models respectively (Appendix table 4).

We did not budget costs for storing as little as 90,000 bushels in the 600,000-bushel elevator. They are 20.4 cents per bushel of capacity used when storing a higher proportion of available capacity—120,000 bushels.

Figure 6 shows the number of bushels and the percent of capacity the 200,000-bushel, 300,000-bushel, and 600,000-bushel elevators will have to use to bring their costs per bushel of capacity occupied down low enough to equal those of the 100,000-bushel model when it uses all its available storage space.

The horizontal line in figure 6 intersects the curved unit-cost line at full use of storage capacity in the 100,000-bushel plus the old 20,000-bushel model. The new 200,000-bushel model will operate at that cost or lower when using from 145,000 to 180,000 bushels of capacity. The 600,000-bushel model will have the same or lower costs in the range between 345,000 bushels—or 58 percent capacity use—and 540,000 bushels, or 90 percent available capacity use.

**SUGGESTION**—You will gain a substantial advantage if you plan the size of your elevator so that it will operate year after year with about all your available storage capacity in use, regardless of the size of elevator needed for your territory.

## On Fixed and Variable Costs

***FINDING—Additional investment below specified maximums in elevator design or new equipment may lower total elevator operating costs.***

In studying the influence of building and equipment on total costs, we found that fixed costs varied from 11.6 to 8.5 percent of the amount invested in a new elevator building. (Appendix tables 5 and 6 show the amounts of fixed expense and the valuations on which the percentages were calculated.)

In other words, depending on the elevator model, it takes from $9 to $11.70 of capital investment in the elevator building to result in $1 of fixed expense (Appendix table 7). Elevator building design influences such annual variable operating cost items as personnel expense, shrinkage, quality deterioration, power, maintenance, and repairs. Obviously, if improved design results in enough savings in annual variable expenses to more than offset the additional fixed cost caused by the design change, overall per unit operating costs will be lowered.

Thus any amount of additional plant cost from $9 to $11.70 may be invested to improve elevator design if it results in $1 of saving in labor, power, shrinkage, and so on. If a plant design change in the 600,000-bushel model can save a man's salary at $4,000 annually, any additional investment necessary for the design change up to $46,000 will result in overall savings in operating cost per unit of volume.

Because the rate of depreciation is higher on elevator equipment than on the elevator building, fixed expenses for equipment vary from 15.3 to 16.6 percent of the amount invested in new equipment. Therefore, an investment in equipment of $6 to $6.50, depending on the size of the model, that results in $1 saved in such variable expenses as labor, power, repairs, shrinkage, quality maintenance and other such costs, results in overall per unit savings in operating costs (Appendix table 7).

**SUGGESTION**—Add your amounts of depreciation, insurance, taxes, and interest on your elevator building or its equipment and divide into the amount invested in either building or equipment to determine the rate of these fixed expense items per $100 invested. Then divide the resulting rate of all fixed expenses into 100 and the answer is the maximum number of dollars you can invest to improve elevator design or to add equipment for each dollar you can save in variable expenses.

***FINDING—Size of new elevator has little influence on variable per unit costs at comparable volumes—particularly above 400,000 bushels.***

At low volume levels—400,000 bushels or less—the variation from one model to another is not more than three-tenths of a cent per bushel merchandised or handled (Appendix table 8). Minimum power bills in the larger elevators account for most of the variation. At volumes of 400,000 bushels or more, unit costs are the same or the difference is not more than one-tenth of a cent for the different models. The variation is even less for the storage function (Appendix table 9).

***FINDING—The variable expense group also contributes to lower unit costs of both grain functions as volume merchandised or handled increases or as storage capacity used increases.***

The heavy line on figure 7 shows all variable costs for merchandising or handling decreased about 1½ cents a bushel over a range of 1.2 million bushels from the 300,000-bushel to the 1.5-million-bushel levels. From 100,000-bushel to 300,000-bushel levels, or over a range of 200,000 bushels, variable unit costs decreased 2½ cents.

The heavy line on figure 8 shows a decrease in variable unit costs for storage of 1 cent within a range of 450,000 bushels between 90,000 and 540,000 bushels of storage capacity used. From 30,000-bushel to 90,000-bushel levels, or within a range of only 60,000 bushels, variable unit costs decreased 1.8 cents per bushel of capacity used.

Figures 9 and 10 show the reaction between fixed and variable costs for each of the grain functions on both amount and per unit basis.

These figures show clearly that fixed costs contribute by far the most to a decrease in unit costs as volume increases, but per unit variable costs do contribute some to the decrease, particularly at low volume levels.

**SUGGESTION**—Since your variable costs will be about the same at a given volume, regardless of the size elevator you build, fixed costs are the important factor in estimating your operating costs per unit of volume. To estimate differences in annual operating expenses for the size of each elevator under consideration at one location, you need only to figure differences in their fixed costs for the average volume anticipated (Appendix figure 9).

## On Tearing Down the Old Elevator

If you decide to build new facilities, you will also have to decide whether to operate your old elevator in conjunction with the new one or to tear the old one down.

In our study we found that the old elevator was used chiefly to merchandise feed grains retailed locally and to supplement receiving and loading out capacity at harvesttime. Thus the costs incident to the merchandising or handling function are the most important ones to consider.

***FINDING—Annual operation of the old 20,000-bushel elevator adds an additional $1,217 to merchandising or handling costs and $217 to storage costs in the model operations used.*** We assumed that no additional personnel would be needed to operate the old elevator. If you feel you will require extra labor above that needed for your new facility, you should add that cost to those shown in appendix table 10.

Appendix figure 11 shows total merchandising or handling costs for the 100,000-bushel, 300,000-bushel, and 600,000-bushel elevators both with and without the old 20,000-bushel model.

***FINDING—Additional costs and volume for operating the old elevator over those for the new one are about the same regardless of the size of the new elevator or the volume of grain merchandised or handled.***

The additional annual volume required to make the combined operations of the old and the new models fall within the unit cost required for operating the new model alone (5.08 cents) is 30,000 bushels, regardless of the size elevator.

***SUGGESTION***—Before you can make your decision whether to tear down your old elevator, you must determine whether it adds enough to your volume and the flexibility of your operations to justify its costs.

## On Adding Equipment

Our study considered the addition of a $20,000 dryer to each model. The same principle would apply to any other piece of expensive equipment.

***FINDING—Installing the dryer added $2,900 to fixed costs of all elevators, regardless of size. But as your volume increases and your unit of fixed costs decreases, it will require more bushels of additional volume to offset the increase in fixed costs caused by the purchase*** (Appendix table 11).

**Here is a good emergency farm storage facility used to care for grain temporarily until elevator storage is available.**

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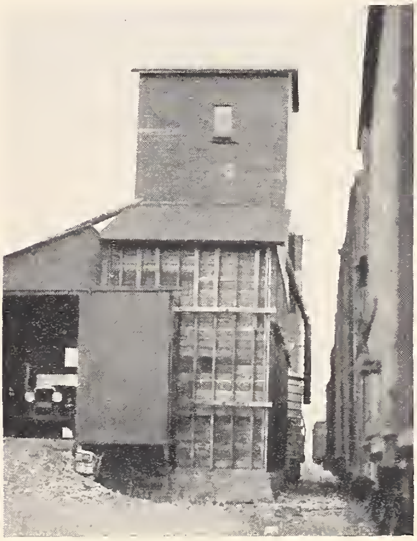
Since the dryer was used to improve the market value of purchased grain containing excessive moisture, the $2,900 fixed cost was a part of the merchandising or handling expense.

Appendix table 11 and figure 12 show the additional volume required to remain at a 4-, 5-, or 6-cent per bushel fixed cost level for merchandising or handling. Thus in the 200,000-bushel and the 300,000-bushel models, it takes only 60,000 additional bushels at 6 cents a bushel to cover the additional $2,900 of fixed cost. Yet it requires 120,000 additional bushels at 4 cents a bushel.

**SUGGESTION**—Any expensive equipment you add will result in higher fixed costs on a per bushel basis. Therefore, you must have more volume to take care of all added costs which additional margins do not cover.

## On Fluctuating Plant Costs

We put cost valuations on the buildings and equipment used in the study models that were average for current construction and installation in the Hard Winter Wheat Belt. These costs may change substantially within the next few years. Therefore, we also set up cost relations for two different situations—20 percent above and 20 percent below those used in the study models.



Many oldtimers like this are still operating.

***FINDING—Cost of building an elevator or the cost of new equipment for an elevator may increase or decrease by 20 percent from the values used in the study models without changing materially the curve representing the relationship between per bushel cost and volume for the different size elevators*** (Appendix figures 13 and 14).

Of course, the curve is higher or lower on the per bushel cost scale depending on the percentage change in new valuations and the resulting change in fixed expense.

**SUGGESTION**—If you build when costs are higher than those indicated in the models, you should plan on more volume in order to operate on a specific competitive level. Or if your building costs are lower, less volume will be necessary (Appendix tables 12 and 13).

## On Sidelines

Our study dealt with sidelines only as they influenced costs of grain merchandising or handling and storage.

**FINDING**—In the elevator models having an annual sideline volume of $30,000, the cost of handling sidelines is $2,789 or about 9 cents for each dollar of sales. When petroleum sales are added to increase volume to $145,000 annually, the cost increases to $15,919, or about 11 cents for each dollar of sales.

***The larger sideline volume brings unit costs of grain merchandising or handling down slightly.*** The models having a sideline volume of $145,000 have grain merchandising or handling costs $535 less than those with a sideline volume of $30,000.

***Grain storage costs were practically the same for sideline volumes of $30,000 and $145,000 regardless of the amount of elevator capacity used for storage.***

**SUGGESTION**—If you intend to increase your sideline volume with your new facilities, plan your layout so that you can use your personnel effectively for both grain merchandising or handling and sidelines. This will help directly to keep your merchandising and handling expense down but only to the extent you can charge less salary and wages to the grain operations. Indirectly sidelines can be helpful in improving patron relations and therefore grain volume.

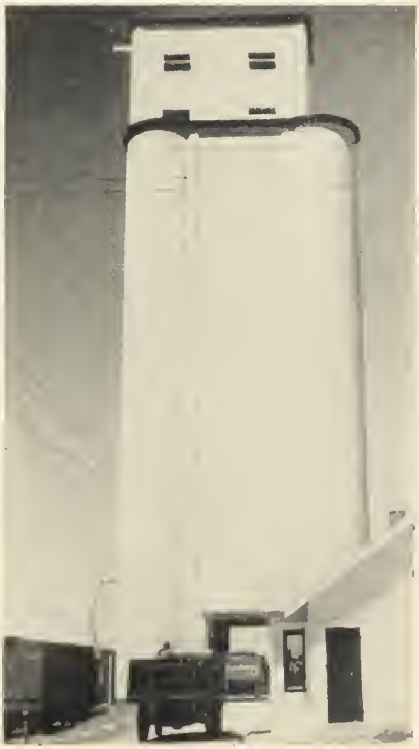
# General Suggestions

ON THE basis of our study we offer the following general suggestions to those who contemplate building new elevator facilities:

1. The most important single step in planning for new elevator and equipment is appraising average volume to be merchandised or handled during the life expectancy of the new elevator. For considerations in making that appraisal, see Where and How Much Cash Grain Storage for North Dakota Farmers, Farm Credit Administration Bulletin No. 61, April 1951, pages 27–51. (Now distributed by Farmer Cooperative Service, United States Department of Agriculture, Washington 25, D. C.)

2. In making your appraisal, it is less costly to be on the conservative side in determining elevator storage capacity. Provision should be made, however, at time of building for adding storage capacity at a later date when your need may be greater or more evident in terms of specific volume.

3. It is better to be on the liberal side in appraising volume to be merchandised or handled, when deciding on receiving and loading out equipment capacity. Once the elevator is built, alterations you may need to increase equipment handling capacity or shipping capacity may be impossible or quite expensive.



This more modern elevator can serve a larger territory more efficiently.

4. When expected annual volume is large enough to allow merchandising or handling operations near the maximum practical volume levels for the two largest elevator model sizes, these elevators have a distinct advantage in competing with the smaller elevators. They can merchandise or handle grain at lower per bushel costs and they can compete with smaller elevators under a wider volume range caused by crop conditions. The larger elevator models also have an advantage over the smaller sizes on storage costs when volume stored is sufficient to use all available storage capacity.

5. Considering the competitive advantages just mentioned, it appears conclusive that the trend toward larger elevators, larger trade territories, and more volume per elevator will continue and, conversely, the smallest elevators with poor trade territories will be eliminated.

6. Both elevator design and equipment changes should be considered from the viewpoint of their influence on annual volume, additional gross margins, and service to farmers as well as their influence on unit costs.

7. In adding sideline operations, better than average management is necessary, as is good overall plant arrangement, for maximum utilization of the same personnel for both sideline and grain functions. Otherwise, the addition of a sideline may add to grain function costs.

8. If you are interested in the details of how we made this study, what procedures we used in arriving at the amounts of the various costs, and how we allocated them to the several elevator functions, write to Farmer Cooperative Service, United States Department of Agriculture, Washington 25, D. C., and ask for a copy of FCS Service Report 12, New Local Elevators—Cost-Volume Relations in the Hard Winter Wheat Belt by Thomas E. Hall, Walter K. Davis, and Howard L. Hall.

# Appendix

## Appendix Table 1.—*Total cents per bushel costs of the grain merchandising or handling functions under various volume situations of the study models* [1]

| Annual volume in bushels merchandised or handled | Cents per bushel of capacity of elevator models | | | | | |
|---|---|---|---|---|---|---|
| | Old 20,000-bushel | New 20,000-bushel | New 100,000-bushel [2] | New 200,000-bushel [2] | New 300,000-bushel [2] | New 600,000-bushel [2] |
| 100,000 | 8.08 | 9.03 | 13.16 | 15.05 | | |
| 150,000 | 5.89 | 6.55 | 9.16 | 10.27 | 11.61 | |
| 200,000 | 4.82 | 5.32 | 7.16 | 7.97 | 8.85 | 10.47 |
| 250,000 | 4.68 | 5.08 | 6.47 | 7.05 | 7.73 | |
| 300,000 | | | 5.63 | 6.14 | 6.63 | 7.69 |
| 400,000 | | | 4.51 | 4.94 | 5.30 | 6.03 |
| 500,000 | | | | 4.28 | 4.55 | 5.08 |
| 600,000 | | | | 3.81 | 4.02 | 4.41 |
| 900,000 | | | | | 3.34 | 3.60 |
| 1,200,000 | | | | | | 2.95 |
| 1,500,000 | | | | | | 2.63 |

[1] Sideline volume is $145,000 annually for each elevator model. At $30,000 sideline volume, the above costs will be higher by $535 divided by the volume of grain merchandised or handled.

[2] The costs shown include all expenses that should be allocated to this function because of the operation of the 20,000-bushel old elevator in conjunction with the new facility.

## Appendix Table 2.—*Increased volume necessary in elevator models to operate at 5.08 cents per bushel*

| Elevator model | Annual volume in bushels | Volume increase from preceding size model |
|---|---|---|
| New 20,000-bushel | 250,000 | 65,000 |
| New 100,000-bushel and old 20,000-bushel | 350,000 | 100,000 |
| New 200,000-bushel and old 20,000-bushel | 390,000 | 40,000 |
| New 300,000-bushel and old 20,000-bushel | 430,000 | 40,000 |
| New 600,000-bushel and old 20,000-bushel | 500,000 | 70,000 |

**Appendix Table 3.—*Elevator model's volume range at per bushel costs of 5.08 cents—lowest cost for the new 20,000-bushel elevator model***

| Elevator model | Annual volume range | | |
|---|---|---|---|
| | Minimum bushels | Maximum bushels | Percentage of maximum needed to compete |
| Old 20,000-bushel | 185, 000 | 250, 000 | 74 |
| New 20,000-bushel | 250, 000 | 250, 000 | 100 |
| New 100,000-bushel and old 20,000-bushel | 350, 000 | 400, 000 | 88 |
| New 200,000-bushel and old 20,000-bushel | 390, 000 | 600, 000 | 60 |
| New 300,000-bushel and old 20,000-bushel | 430, 000 | 900, 000 | 48 |
| New 600,000-bushel and old 20,000-bushel | 500, 000 | 1, 500, 000 | 33 |

**Appendix Table 4.—*Costs per bushel of storage capacity used by grain storage function under various volume situations in the study models* [1]**

| Bushels of storage capacity used | Cents per bushel of storage capacity used for each model elevator | | | | |
|---|---|---|---|---|---|
| | New 20,000 bu. | New [2] 100,000 bu. | New [2] 200,000 bu. | New [2] 300,000 bu. | New [2] 600,000 bu. |
| 15,000 | 11. 44 | | | | |
| 30,000 | | 19. 47 | | | |
| 60,000 | | 10. 27 | 15. 74 | | |
| 90,000 | | 7. 32 | 10. 92 | 14. 46 | |
| 120,000 | | | 8. 52 | 11. 21 | 20. 40 |
| 180,000 | | | 6. 11 | 7. 88 | 13. 00 |
| 270,000 | | | | 5. 67 | 9. 10 |
| 360,000 | | | | | 7. 13 |
| 540,000 | | | | | 5. 14 |

[1] The expenses shown are the same for either level of sideline volume used in the study models.

[2] The costs shown include all expenses that should be allocated to this function because of the operation of the 20,000-bushel old elevator in conjunction with the new facility.

## Appendix Table 5.—*Analysis of annual fixed expenses for the grain merchandising or handling function for each of the elevator models*

| Elevator models | The grain merchandising or handling function | | | | |
|---|---|---|---|---|---|
| | Expenses of depreciation, insurance, taxes and interest on investment | | Interest on regular working capital[3] | Other fixed expenses[4] | Total fixed expenses |
| | Plant[1] | Equipment[2] | | | |
| Old 20,000-bushel: | | | | | |
| Valuation | [5] $2, 000 | $10, 100 | $5, 000 | ...... | ....... |
| Expense | 336 | 1, 564 | 200 | $75 | $2, 175 |
| New 20,000-bushel: | | | | | |
| Valuation | 11, 010 | 11, 970 | 5, 000 | ....... | ....... |
| Expense | 1, 272 | 1, 877 | 200 | 75 | 3, 424 |
| New 100,000-bushel and old 20,000-bushel: | | | | | |
| Valuation | 28, 000 | 28, 850 | 5, 500 | ...... | ....... |
| Expense | 2, 482 | 4, 466 | 220 | 384 | 7, 552 |
| New 200,000-bushel and old 20,000-bushel: | | | | | |
| Valuation | 33, 200 | 34, 100 | 6, 000 | ....... | ....... |
| Expense | 2, 931 | 5, 271 | 240 | 686 | 9, 128 |
| New 300,000-bushel and old 20,000-bushel: | | | | | |
| Valuation | 37, 500 | 38, 600 | 7, 500 | ....... | ....... |
| Expense | 3, 290 | 5, 974 | 300 | 1, 013 | 10, 577 |
| New 600,000-bushel and old 20,000-bushel: | | | | | |
| Valuation | 47, 400 | 47, 860 | 9, 000 | ....... | ....... |
| Expense | 4, 123 | 7, 329 | 360 | 1, 365 | 13, 177 |

[1] Office building is included as plant expense at $2,000 valuation.

[2] Truck, scale and office equipment included at $5,000 valuation.

[3] This is the amount of interest at 4 percent on working capital used regularly throughout the year or minimum requirements, as contrasted to seasonal working capital.

[4] Other fixed expenses are the portion of personnel expenses due to facility size, capital stock tax, employees bond, and railroad lease.

[5] Old elevator building is depreciated completely, but for insurance and tax purposes it has a replacement value of about $9,000.

*Note.*—These expenses all remain the same regardless of annual volume merchandised or handled, or the amount of available storage capacity used.

*Note.*—Ratios of grain merchandising or handling plant and equipment expense to valuations are about 1 to 8.8 and 15,5 respectively for the new concrete elevator models. For the storage function they are about 1 to 8.5 for plant and 1 to 16.3 for equipment.

## Appendix Table 6.—*Analysis of annual fixed expenses for the grain storage function for each of the elevator models*

| Elevator models | The grain storage function | | | |
|---|---|---|---|---|
| | Expense of depreciation, insurance, taxes and interest on investment | | Other fixed expenses[1] | Total fixed expenses |
| | Plant | Equipment | | |
| Old 20,000-bushel: | | | | |
| Valuation | .......... | $900 | .......... | .......... |
| Expense | $44 | 138 | $25 | $207 |
| New 20,000-bushel: | | | | |
| Valuation | 6, 005 | 1, 230 | .......... | .......... |
| Expense | 666 | 204 | 25 | 895 |
| New 100,000-bushel and old 20,000-bushel: | | | | |
| Valuation | 39, 000 | 7, 150 | .......... | .......... |
| Expense | 3, 339 | 1, 187 | 116 | 4, 642 |
| New 200,000-bushel and old 20,000-bushel: | | | | |
| Valuation | 72, 800 | 8, 900 | .......... | .......... |
| Expense | 6, 223 | 1, 455 | 173 | 7, 851 |
| New 300,000-bushel and old 20,000-bushel: | | | | |
| Valuation | 106, 500 | 10, 400 | .......... | .......... |
| Expense | 9, 072 | 1, 702 | 230 | 11, 004 |
| New 600,000-bushel and old 20,000-bushel: | | | | |
| Valuation | 181, 600 | 27, 140 | .......... | .......... |
| Expense | 15, 552 | 4, 378 | 300 | 20, 230 |

[1] Other fixed expenses are the State warehouse bond and personnel expense due to size of facility.

*Note.*—These expenses all remain the same regardless of annual volume merchandised or handled, or the amount of available storage capacity used.

*Note.*—Ratios of grain merchandising or handling plant and equipment expense to valuations are about 1 to 8.8 and 15.5 respectively for the new concrete elevator models. For the storage function, they are about 1 to 8.5 for plant and 1 to 16.3 for equipment.

**Appendix Table 7.**—*Percentage relationships of the expense of depreciation, interest, taxes, and insurance to the investment or cost of plant and equipment and the ratio at which the investment cost equals a dollar saved in variable expenses for the model elevators* [1]

| Elevator models | Grain merchandising or handling | | | | Grain storage | | | |
|---|---|---|---|---|---|---|---|---|
| | Elevator Building | | Equipment | | Elevator Building | | Equipment | |
| | Percentage | Ratio [2] | Percentage | Ratio [2] | Percentage | Ratio [2] | Percentage | Ratio [2] |
| New 20,000-bushel | 11.6 | $1 to $9.00 | 15.7 | $1 to $6.40 | 11.1 | $1 to $9.00 | 16.6 | $1 to $6.00. |
| New 100,000-bushel and old 20,000-bushel | 8.9 | $1 to $11.30 | 15.5 | $1 to $6.50 | 8.6 | $1 to $11.70 | 16.6 | $1 to $6.00. |
| New 200,000-bushel and old 20,000-bushel | 8.8 | $1 to $11.30 | 15.5 | $1 to $6.50 | 8.6 | $1 to $11.70 | 16.4 | $1 to $6.10. |
| New 300,000-bushel and old 20,000-bushel | 8.8 | $1 to $11.40 | 15.5 | $1 to $6.50 | 8.5 | $1 to $11.70 | 16.4 | $1 to $6.10. |
| New 600,000-bushel and old 20,000-bushel | 8.7 | $1 to $11.50 | 15.3 | $1 to $6.50 | 8.5 | $1 to $11.70 | 16.1 | $1 to $6.20. |

[1] Percentages and ratios are calculated from data shown in table 6.

[2] Ratio of variable expense to cost of investment in facilities and equipment.

*Note.*—The variations shown above are due to the relative weight of the depreciation and insurance rates making up the composite percentage or ratio on both the old and new elevators. On a new concrete elevator plant by itself the composite rate would be 8.43 percent. On equipment it would be 14.37 percent.

## Appendix Table 8.—*Variation due to volume in the amount and the per bushel variable expenses for the grain merchandising or handling function for the elevator models*[1]

| Annual volume in bushels merchandised or handled | Variable expenses for the elevator models[2] | | | | | |
|---|---|---|---|---|---|---|
| | Old 20,000-bushel | New 20,000-bushel | New 100,000-bushel[3] | New 200,000-bushel[3] | New 300,000-bushel[3] | New 600,000-bushel[3] |
| 100,000: | | | | | | |
| Amount..........dollars.. | 5, 907 | 5, 602 | 5, 607 | 5, 920 | ........ | ........ |
| Per bushel..........cents.. | 5. 9 | 5. 6 | 5. 6 | 5. 9 | ........ | ........ |
| 150,000: | | | | | | |
| Amount..........dollars.. | 6, 653 | 6, 399 | 6, 183 | 6, 279 | 6, 852 | ........ |
| Per bushel..........cents.. | 4. 4 | 4. 3 | 4. 1 | 4. 2 | 4. 6 | ........ |
| 200,000: | | | | | | |
| Amount..........dollars.. | 7, 474 | 7, 215 | 6, 773 | 6, 816 | 7, 137 | ........ |
| Per bushel..........cents.. | 3. 7 | 3. 6 | 3. 4 | 3. 4 | 3. 6 | ........ |
| 250,000: | | | | | | |
| Amount..........dollars.. | 9, 522 | 9, 271 | 8, 615 | 8, 507 | 8, 806 | ........ |
| Per bushel..........cents.. | 3. 8 | 3. 7 | 3. 4 | 3. 4 | 3. 5 | ........ |
| 300,000: | | | | | | |
| Amount..........dollars.. | ........ | ........ | 9, 348 | 9, 287 | 9, 329 | 9, 903 |
| Per bushel..........cents.. | ........ | ........ | 3. 1 | 3. 1 | 3. 1 | 3. 3 |
| 400,000: | | | | | | |
| Amount..........dollars.. | ........ | ........ | 10, 486 | 10, 649 | 10, 642 | 10, 961 |
| Per bushel..........cents.. | ........ | ........ | 2. 6 | 2. 7 | 2. 7 | 2. 7 |
| 500,000: | | | | | | |
| Amount..........dollars.. | ........ | ........ | ........ | 12, 272 | 12, 198 | 12, 220 |
| Per bushel..........cents.. | ........ | ........ | ........ | 2. 4 | 2. 4 | 2. 4 |
| 600,000: | | | | | | |
| Amount..........dollars.. | ........ | ........ | ........ | 13, 714 | 13, 572 | 13, 279 |
| Per bushel..........cents.. | ........ | ........ | ........ | 2. 3 | 2. 3 | 2. 2 |
| 900,000: | | | | | | |
| Amount..........dollars.. | ........ | ........ | ........ | ........ | 19, 530 | 19, 178 |
| Per bushel..........cents.. | ........ | ........ | ........ | ........ | 2. 1 | 2. 1 |
| 1,200,000: | | | | | | |
| Amount..........dollars.. | ........ | ........ | ........ | ........ | ........ | 22, 172 |
| Per bushel..........cents.. | ........ | ........ | ........ | ........ | ........ | 1. 8 |
| 1,500,000: | | | | | | |
| Amount..........dollars.. | ........ | ........ | ........ | ........ | ........ | 26, 231 |
| Per bushel..........cents.. | ........ | ........ | ........ | ........ | ........ | 1. 7 |

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[1] The expenses shown are all other expenses not shown in table 6—fixed expenses.

[2] Management would ordinarily be a factor in the variations shown. However, every effort was made to budget these expenses on the basis that management was comparable for the level of responsibility existing in each model. Therefore, the variations shown are believed to be due to the different level of annual volume shown for each model.

[3] This model includes the appropriate costs incident to operating the old 20,000-bushel elevator in conjunction with the new one.

*Note.*—Sideline volume in each example is $145,000 for the expenses shown. When it is $30,000 annually, each amount figure shown is about $535 higher.

**Appendix Table 9.—*Variation due to storage capacity used in the amount and the per bushel variable expenses for the grain storage function for the elevator models*** [1]

| Maximum storage capacity used in bushels | Annual variable expenses for the elevator models [2] | | | | | |
|---|---|---|---|---|---|---|
| | Old 20,000-bushel | New 20,000-bushel | New 100,000-bushel [3] | New 200,000-bushel [3] | New 300,000-bushel [3] | New 600,000-bushel [3] |
| 15,000: | | | | | | |
| Amount . . . . . . . . . . dollars | 1,075 | 821 | 1,050 | ........ | ........ | ........ |
| Per bushel . . . . . . . . . . cents | 7.17 | 5.47 | 7.00 | ........ | ........ | ........ |
| 30,000: | | | | | | |
| Amount . . . . . . . . . . dollars | ........ | ........ | 1,200 | ........ | ........ | ........ |
| Per bushel . . . . . . . . . . cents | ........ | ........ | 4.00 | ........ | ........ | ........ |
| 60,000: | | | | | | |
| Amount . . . . . . . . . . dollars | ........ | ........ | 1,520 | 1,598 | ........ | ........ |
| Per bushel . . . . . . . . . . cents | ........ | ........ | 2.53 | 2.66 | ........ | ........ |
| 90,000: | | | | | | |
| Amount . . . . . . . . . . dollars | ........ | ........ | 1,945 | 1,985 | 2,010 | ........ |
| Per bushel . . . . . . . . . . cents | ........ | ........ | 2.16 | 2.21 | 2.23 | ........ |
| 120,000: | | | | | | |
| Amount . . . . . . . . . . dollars | ........ | ........ | ........ | 2,373 | 2,442 | ........ |
| Per bushel . . . . . . . . . . cents | ........ | ........ | ........ | 1.98 | 2.04 | ........ |
| 180,000: | | | | | | |
| Amount . . . . . . . . . . dollars | ........ | ........ | ........ | 3,150 | 3,174 | 3,173 |
| Per bushel . . . . . . . . . . cents | ........ | ........ | ........ | 1.75 | 1.76 | 1.76 |
| 270,000: | | | | | | |
| Amount . . . . . . . . . . dollars | ........ | ........ | ........ | ........ | 4,314 | 4,333 |
| Per bushel . . . . . . . . . . cents | ........ | ........ | ........ | ........ | 1.60 | 1.60 |
| 360,000: | | | | | | |
| Amount . . . . . . . . . . dollars | ........ | ........ | ........ | ........ | ........ | 5,433 |
| Per bushel . . . . . . . . . . cents | ........ | ........ | ........ | ........ | ........ | 1.51 |
| 540,000: | | | | | | |
| Amount . . . . . . . . . . dollars | ........ | ........ | ........ | ........ | ........ | 7,548 |
| Per bushel . . . . . . . . . . cents | ........ | ........ | ........ | ........ | ........ | 1.40 |

[1] The expenses shown are all other expenses not included in table 7—fixed expenses.

[2] Management would ordinarily be a factor influencing the variations shown. However, every effort was made to budget these costs on the basis that management was comparable for the respective level of responsibility existing in each model. Therefore, the variations shown are believed to be due to different levels of annual volume shown for each elevator model.

[3] This model includes the appropriate expenses incident to operating the old 20,000-bushel elevator in conjunction with the new one.

*Note.*—Sideline volume is not a factor influencing storage expenses at any volume level.

## Appendix Table 10.—*Old 20,000-bushel elevator costs that are additions to operating the new concrete elevator models independently*

| Expense item | Merchandising or handling |  |  | Storage |  |  |
|---|---|---|---|---|---|---|
|  | Plant | Equipment | Total | Plant | Equipment | Total |
| Depreciation | ... | $510 | $510 | ... | $90 | $90 |
| Taxes | $100 | 66 | 166 | $32 | 13 | 45 |
| Insurance | 64 | 43 | 107 | 12 | ... | 12 |
| Interest | ... | 204 | 204 | ... | 45 | 45 |
| Subtotal fixed costs | 164 | 823 | 987 | 44 | 148 | 192 |
| Power and lights [1] | ... | ... | ... | ... | ... | 25 |
| Repairs and maintenance [2] | ... | ... | 175 | ... | ... | ... |
| Plant supplies [3] | ... | ... | 20 | ... | ... | ... |
| Insurance on stocks [4] | ... | ... | 35 | ... | ... | ... |
| Other expense [5] | ... | ... | ... | ... | ... | ... |
| Total | ... | ... | 1,217 | ... | ... | 217 |

[1] At a cost of 5 cents a bushel, volume would be sufficient so that power minimum would not be a factor. At low annual volume it is an additional cost because of minimum power bills. At 100,000-bushel volume the old elevator operation should be charged with adding $121 to the power bill.

[2] Of the $250 charged for repair and maintenance of the old elevator, it is estimated that eliminating it would reduce the total by $200 for the same volume.

[3] Primarily differences in fumigation costs in old elevator.

[4] Insurance on stocks is the difference in costs of carrying stocks budgeted in the old elevator as additions to those previously carried in the new concrete elevator.

[5] Expenses such as extra personnel expense should be added here if they apply to a specific building location.

## Appendix Table 11.—*Volume—Total unit cost relations when fixed expenses are increased $2,900 by installation of additional equipment for merchandising or handling* [1]

| Elevator models | Increased bushel volume [2] necessary when unit costs are— |  |  |
|---|---|---|---|
|  | 4 cents | 5 cents | 6 cents |
| New 100,000-bushel and old 20,000-bushel | ... | 80, 000 | 60, 000 |
| New 200,000-bushel and old 20,000-bushel | 120, 000 | 80, 000 | 60, 000 |
| New 300,000-bushel and old 20,000-bushel | 120, 000 | 80, 000 | 60, 000 |
| New 600,000-bushel and old 20,000-bushel | 140, 000 | 80, 000 | 60, 000 |

[1] This is computed from the fixed expenses shown for each of the elevator models in table 6.

[2] This is the additional annual volume necessary to allow the $2,900 additional fixed expense to operate with the same total unit costs as that of the study models operating with standard equipment.

**Appendix Table 12.—*Annual grain merchandising or handling volume response at specified per bushel cost levels to valuations on both elevator building and equipment in new elevators that are 20 percent higher and 20 percent lower than those used in the study models***

| New elevator models | Volume necessary at 4 cents per bushel cost | | | Volume necessary at 5 cents per bushel cost | | | Volume necessary at 6 cents per bushel cost | | |
|---|---|---|---|---|---|---|---|---|---|
| | At model valuations | Change when valuations were— | | At model valuations | Change when valuations were— | | At model valuations | Change when valuations were— | |
| | | 20 percent higher | 20 percent lower | | 20 percent higher | 20 percent lower | | 20 percent higher | 20 percent lower |
| New 100,000-bushel plus old 20,000-bushel | (1) | (1) | (1) | 350, 000 | +35, 000 | −30, 000 | 275, 000 | +30, 000 | −25, 000 |
| New 200,000-bushel plus old 20,000-bushel | 550, 000 | +60, 000 | −50, 000 | 395, 000 | +45, 000 | −40, 000 | 310, 000 | +35, 000 | −30, 000 |
| New 300,000-bushel plus old 20,000-bushel | 600, 000 | +80, 000 | −65, 000 | 435, 000 | +50, 000 | −45, 000 | 340, 000 | +40, 000 | −35, 000 |
| New 600,000-bushel plus old 20,000-bushel | 700, 000 | +115, 000 | −85, 000 | 510, 000 | +60, 000 | −55, 000 | 405, 000 | +45, 000 | −40, 000 |

[1] Volumes necessary are above those generally considered practical for this size elevator.

*Note.*—The two different levels of sideline volume are not a factor influencing the above data.

### Appendix Table 13.—*Relationships between storage capacity used in the elevator models under three situations of facility and equipment costs*

| Elevator models | Current or model building costs [1] |  | New elevator costs 20 percent higher than models |  | New elevator costs 20 percent lower than models |  |
|---|---|---|---|---|---|---|
|  | Capacity used | Change [2] | Capacity used | Increase[3] | Capacity used | Decrease[3] |
| (A) Average cost per bushel of capacity used is 10 cents per bushel |  |  |  |  |  |  |
| New 100,000-bushel and old 20,000-bushel | 62,000 | ......... | 71,000 | +13,000 | 53,000 | −9,000 |
| New 200,000-bushel and old 20,000-bushel | 98,000 | +36,000 | 117,000 | +19,000 | 83,000 | −15,000 |
| New 300,000-bushel and old 20,000-bushel | 137,000 | +39,000 | 161,000 | +24,000 | 113,000 | −24,000 |
| New 600,000-bushel and old 20,000-bushel | 240,000 | +108,000 | 287,000 | +47,000 | 195,000 | −45,000 |
| (B) Average storage cost per bushel of capacity used is 8.5 cents per bushel |  |  |  |  |  |  |
| New 100,000-bushel and old 20,000-bushel | 76,000 | ......... | 87,000 | +11,000 | 63,000 | −13,000 |
| New 200,000-bushel and old 20,000-bushel | 120,000 | +48,000 | 141,000 | +21,000 | 100,000 | −19,000 |
| New 300,000-bushel and old 20,000-bushel | 165,000 | +45,000 | 193,000 | +28,000 | 138,000 | −27,000 |
| New 600,000-bushel and old 20,000-bushel | 292,000 | +127,000 | 347,000 | +55,000 | 235,000 | −47,000 |
| (C Average storage cost per bushel of capacity used is 7.0 cents per bushel |  |  |  |  |  |  |
| New 100,000-bushel and old 20,000-bushel | 94,000 | ......... | Can't store enough |  | 80,000 | −14,000 |
| New 200,000-bushel and old 20,000-bushel | 150,000 | +58,000 | 177,000 | +28,000 | 126,000 | −24,000 |
| New 300,000-bushel and old 20,000-bushel | 206,000 | +56,000 | 242,000 | +36,000 | 172,000 | −34,000 |
| New 600,000-bushel and old 20,000-bushel | 365,000 | +158,000 | 428,000 | +63,000 | 303,000 | −62,000 |

---

[1] Current building and equipment costs refer to those used for the principal study models.

[2] This is the increase in use of capacity in the next larger size plant necessary to have equal costs at the cost level used.

[3] This is the change in capacity used from current amounts (column 1) necessary to have equal costs at the level used in the same elevator models.

*Note.*—The two different levels of sideline volume are not a factor influencing the above data.

Figure 1.—Type of new elevator design and equipment installation used in the 20,000-bushel elevator model.

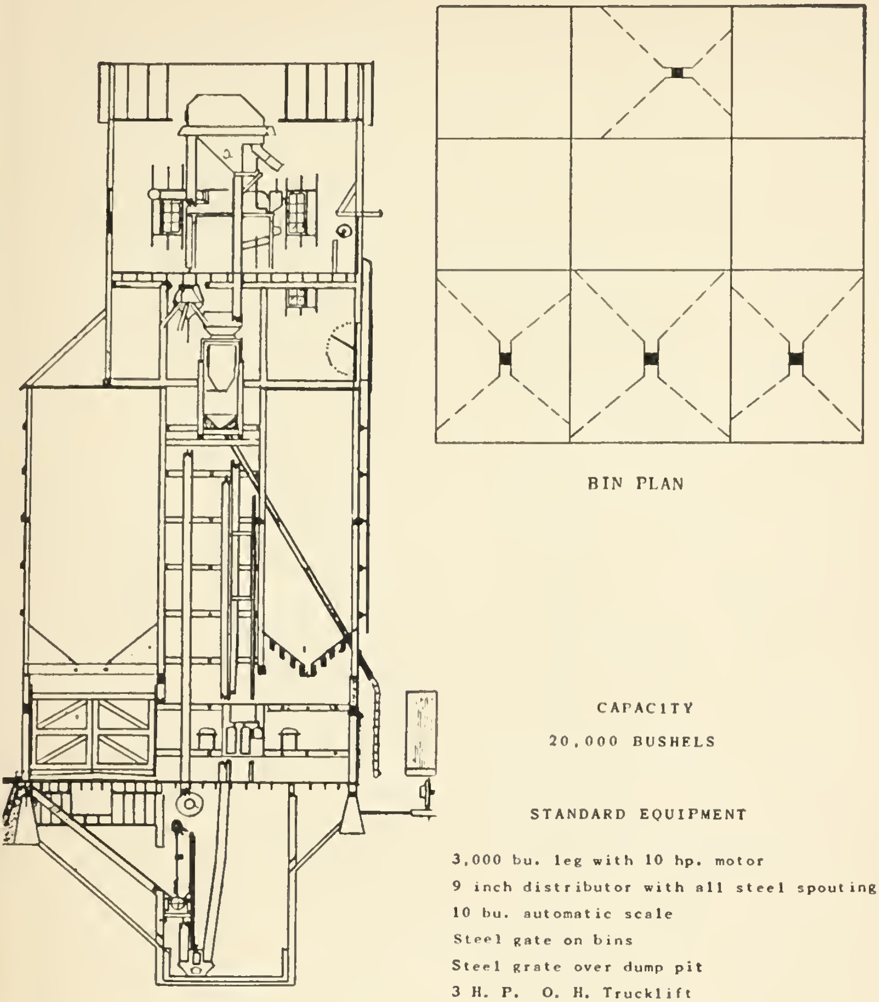
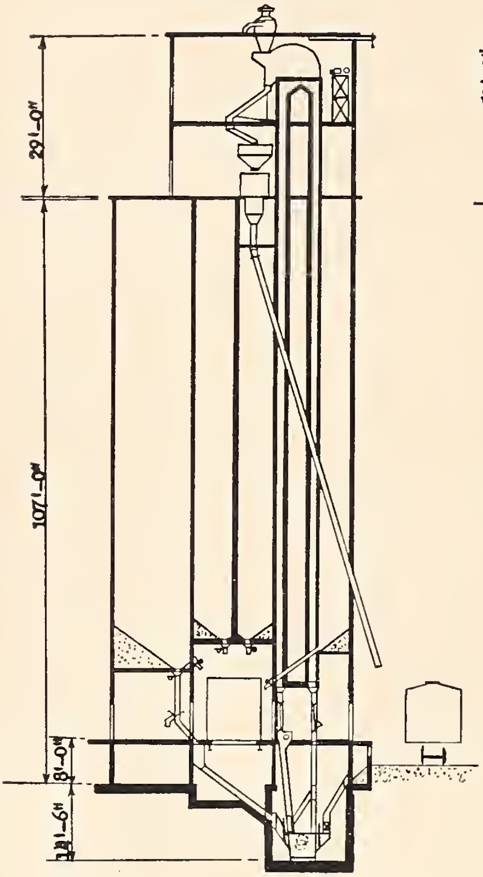
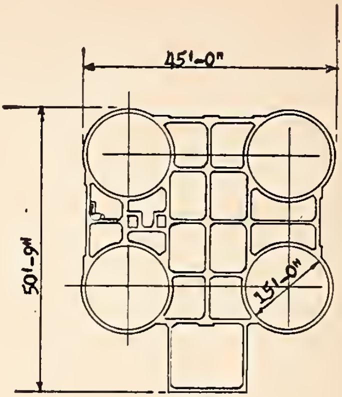


Figure 2.—Type of new elevator design and equipment installation used in the 100,000-bushel elevator model.



SECTION



BIN PLAN

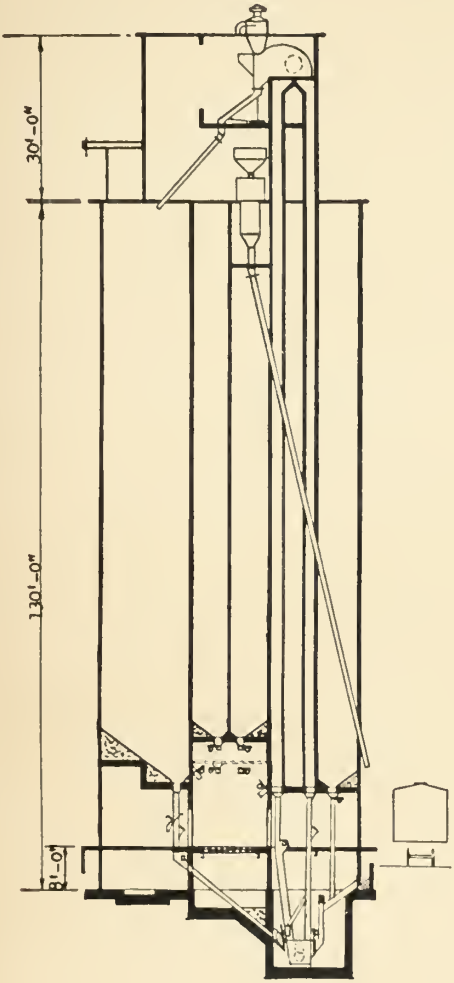
CAPACITY

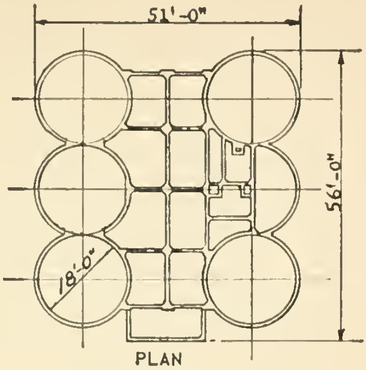
| | |
|---|---|
| 2 BINS | 15,100 BU. EA. |
| 2 BINS | 14,250 BU. EA. |
| 2 BINS | 5,700 BU. EA. |
| 2 BINS | 3,600 BU. EA. |
| 2 BINS | 3,550 BU. EA. |
| 2 BINS | 3,300 BU. EA. |
| 2 BINS | 2,000 BU. EA. |
| 1 BIN | 3,400 BU. |
| 1 BIN | 2,700 BU. |
| GRAND TOTAL: | 101,200 BUSHELS |

STANDARD EQUIPMENT

All steel leg casing and spouting.
All over head bin valves with R&P.
Two steel curtain driveway doors.
Two dump pits with grates.
7½ H.P. O.H. Trucklift.
All steel 3070 doors.
L. O. S. Well Casing.
10-Bu. automatic scale.
5,000 bushel leg.

Figure 3.—Type of new elevator design and equipment installation used in the 200,000-bushel elevator model.





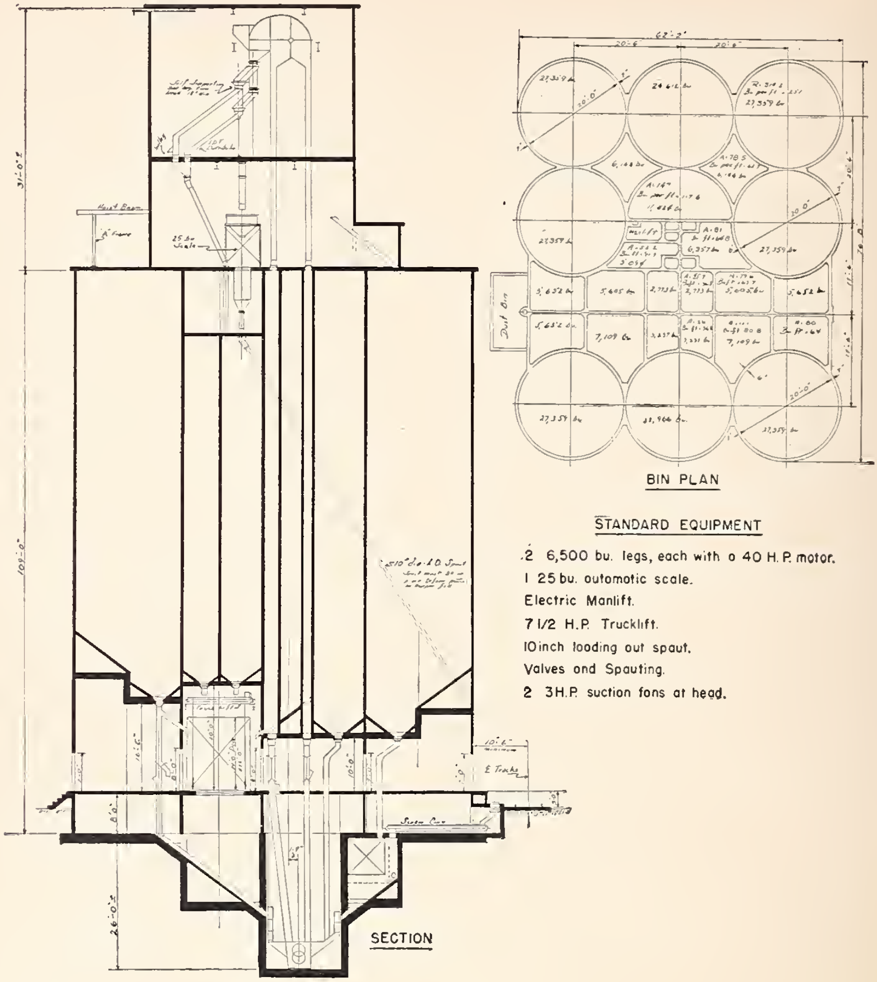
CAPACITY

| | |
|---|---|
| 2 BINS | 25,654 BU. EA. |
| 2 BINS | 24,941 BU. EA. |
| 1 BIN | 20,564 BU. |
| 1 BIN | 10,957 BU. |
| 1 BIN | 8,303 BU. |
| 1 BIN | 7,977 BU. |
| 1 BIN | 6,272 BU. |
| 1 BIN | 5,824 BU. |
| 1 BIN | 5,660 BU. |
| 1 BIN | 5,570 BU. |
| 1 BIN | 5,434 BU. |
| 1 BIN | 5,347 BU. |
| 1 BIN | 3,381 BU. |
| 1 BIN | 2,536 BU. |
| 1 BIN | 2,301 BU. |
| 1 BIN | 1,840 BU. |
| GRAND TOTAL | 200,076 BUSHELS |

STANDARD EQUIPMENT

All steel leg casing and spouting.
All over head bin valves with R & P.
Two steel curtain driveway doors.
Two dump pits with grates.
7½ H.P. O.H. Trucklift.
All steel 3070 doors.
L. O. S. Well Casing.
Electric Manlift.
15-Bu. automatic scale.
6,500 bushel leg.

Figure 4.—Type of new elevator design and equipment installation used in the 300,000-bushel elevator model.



STANDARD EQUIPMENT

2 6,500 bu. legs, each with a 40 H.P. motor.
1 25 bu. automatic scale.
Electric Manlift.
7 1/2 H.P. Trucklift.
10 inch loading out spout.
Valves and Spouting.
2 3H.P. suction fans at head.

Figure 5.—Relation of cost to volume of grain merchandised or handled by size of elevator.

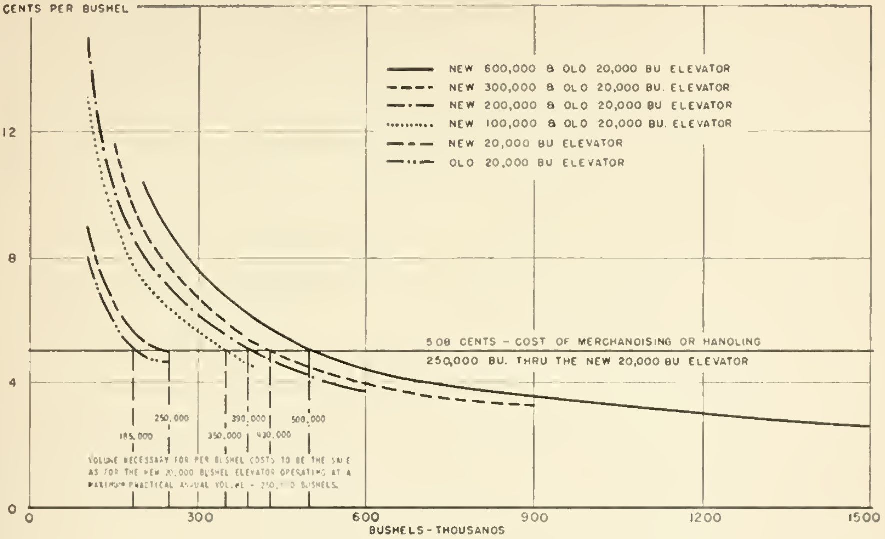
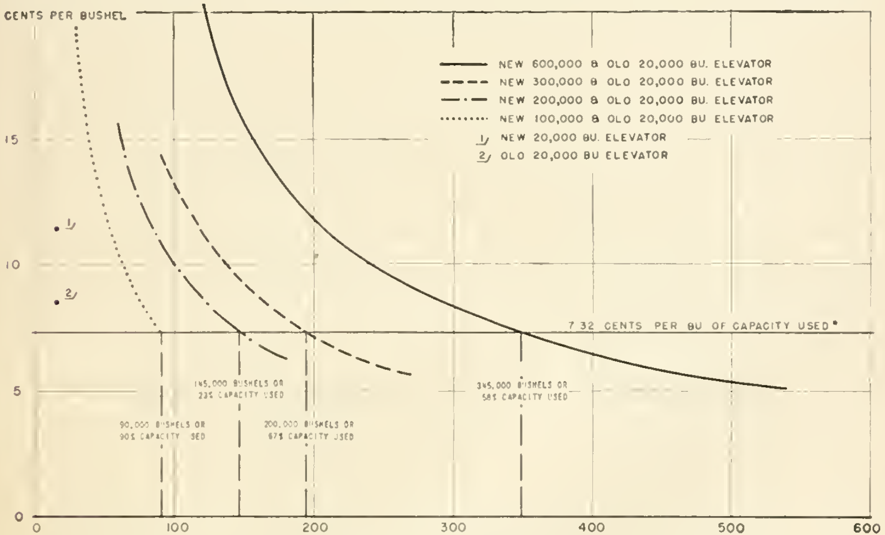
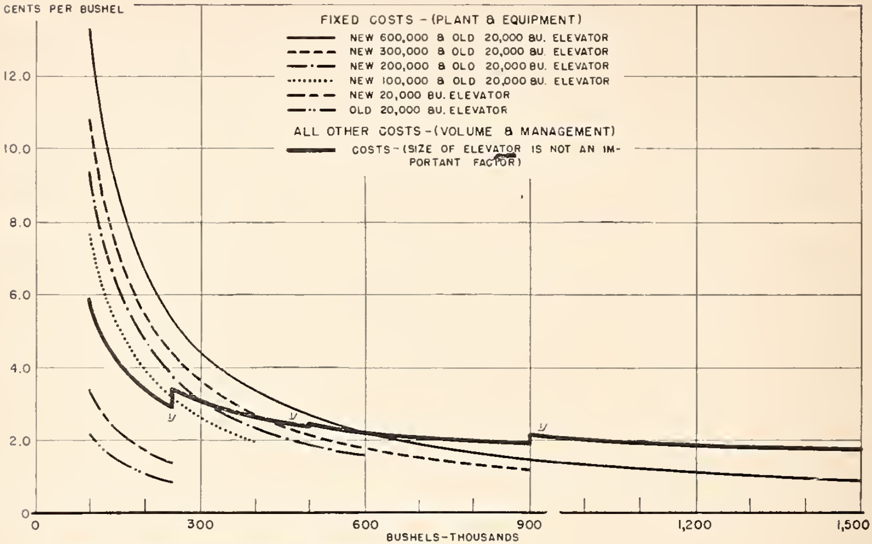


Figure 6.—Relation of cost to volume of grain stored by size of elevator.



*NEW 100,000 BU ELEVATOR EXAMPLE USING 90,000 BU OF AVAILABLE CAPACITY

Figure 7.—Relation of fixed and variable costs to volume of grain merchandised or handled by size of elevator.



1/POINTS AT WHICH REGULARLY EMPLOYED PERSONNEL WERE ADDED.

Figure 8.—Relation of fixed and variable costs to storage capacity used by size of elevator.

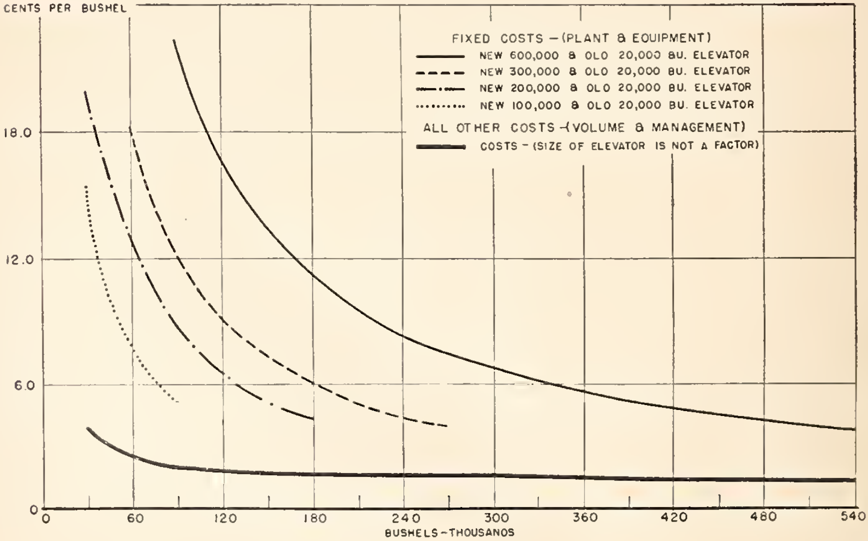


Figure 9.—Relation of fixed expense to total expense of grain functions at high and low practical volume levels by size of elevator in thousands of dollars.

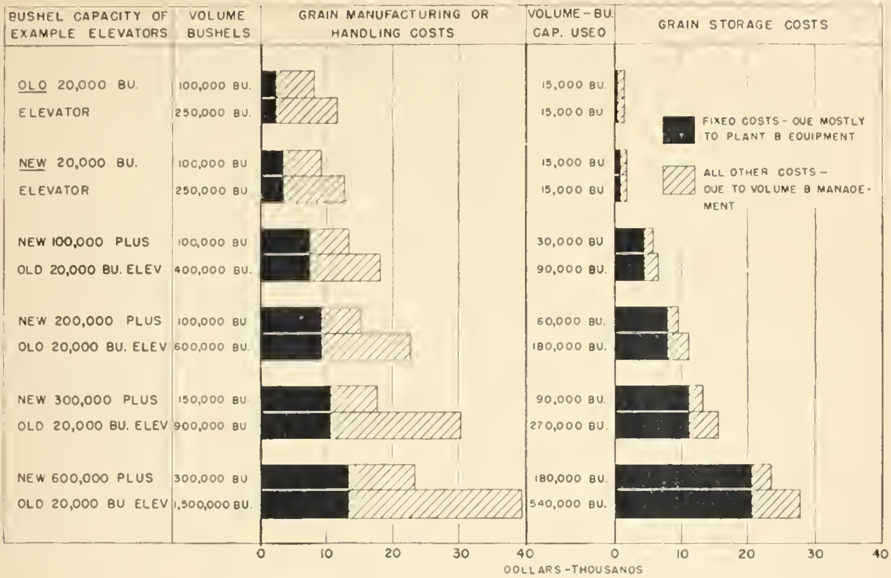


Figure 10.—Relation of cents per bushel fixed expense to total expense of grain functions at high and low practical volume levels by size of elevator.

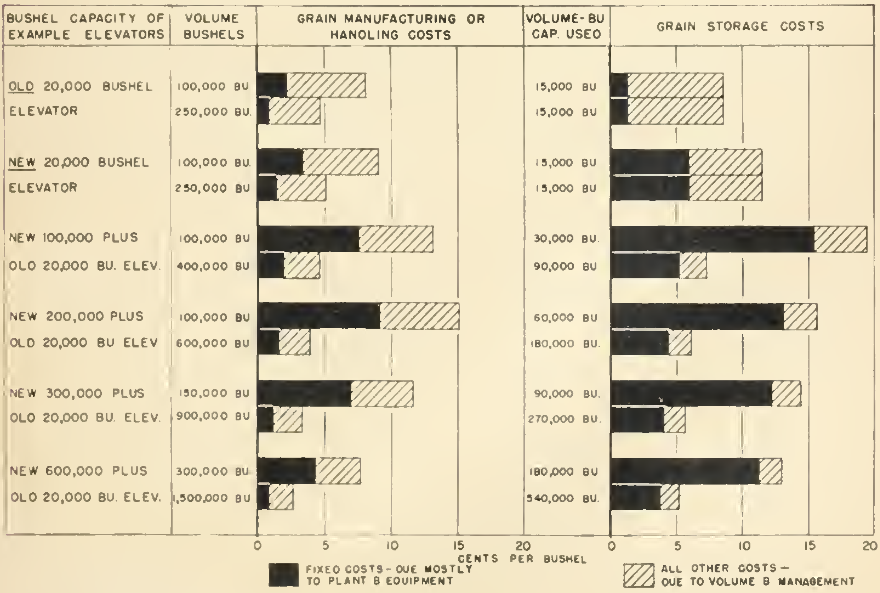


Figure 11.—Relation of cost to volume of grain merchandised or handled by new elevators with and without the old elevator.

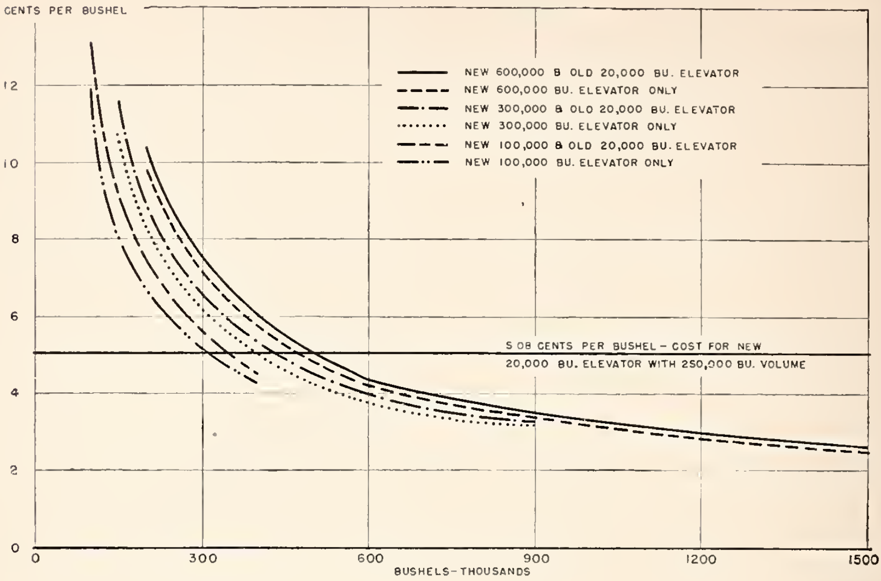


Figure 12.—Relation of cost to volume of grain merchandised or handled by new elevator with and without grain dryer.

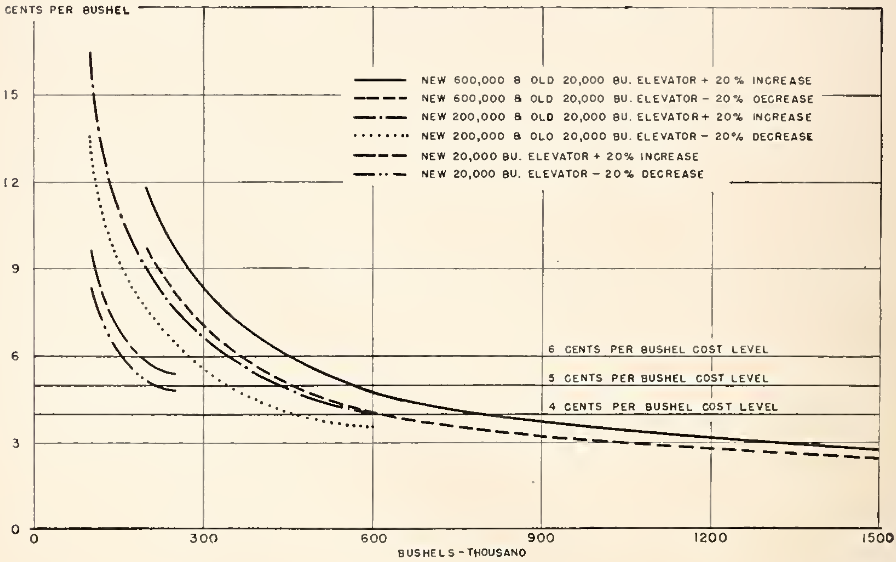


Figure 13.—Relation of cost to volume of grain merchandised or handled by new elevator valued at 20-percent lower and 20-percent higher than elevator models.

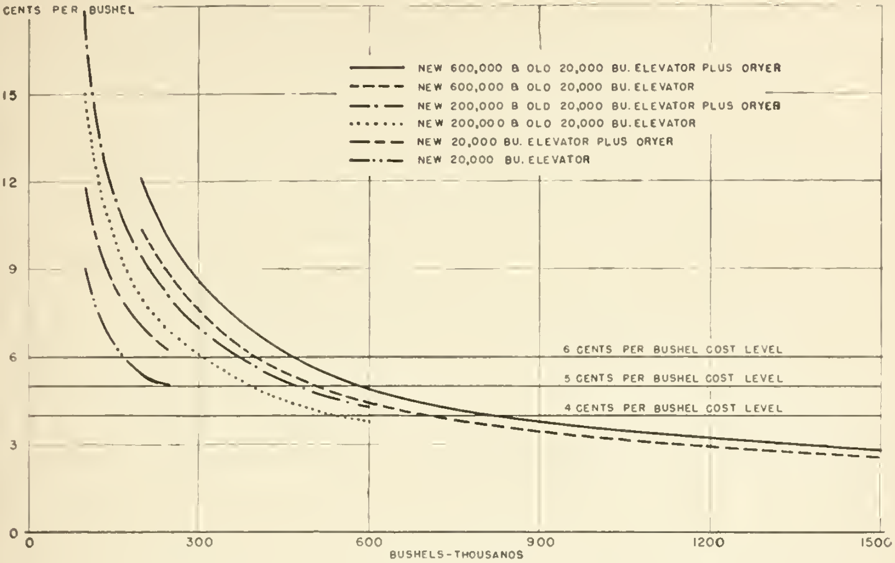
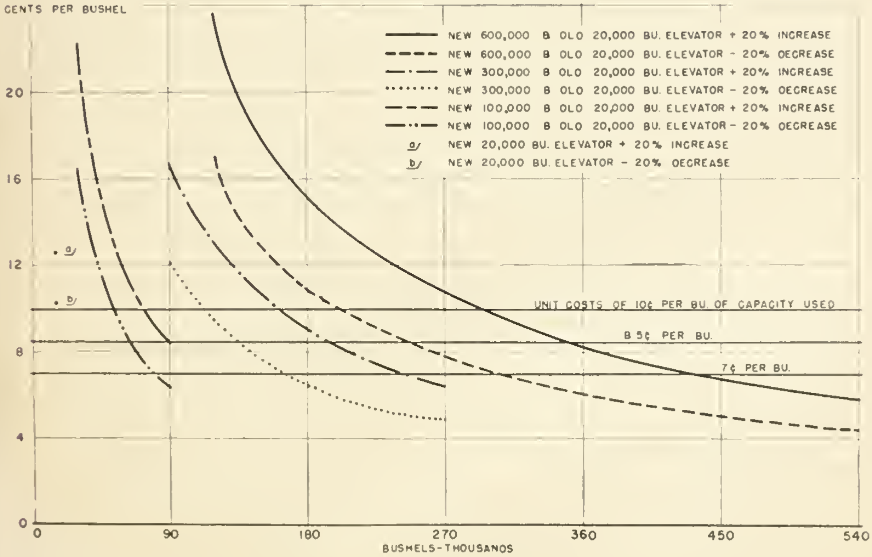


Figure 14.—Relation of cost to volume of grain stored by new elevator valued at 20-percent lower and higher than elevator models.



## Other Publications Available

Farmer Cooperatives in the United States, FCS Bulletin 1.

Changing Grain Storage Costs—Farm vs. Elevator, FCS Circular 6, *Thomas E. Hall.*

Where and How Much Cash Grain Storage for Oklahoma Farmers, Bulletin 58, *Thomas E. Hall, A. L. Larson, H. S. Whitney,* and *C. H. Meyer.*

Where and How Much Cash Grain Storage for North Dakota Farmers, Bulletin 61, *Thomas E. Hall, P. V. Hemphill, C. H. Meyer,* and *W. K. Davis.*

Where and How Much Cash Grain Storage for Indiana Farmers, Bulletin 68, *Thomas E. Hall, J. W. Hicks, W. K. Davis,* and *Norman Coats.*

Using Your Co-op Elevator, Circular E–8, *Harold Hedges.*

Artificial Corn Drying by Selected Elevators in Indiana, General Report 5, *Walter K. Davis* and *James A. Shute.*

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Copies of these and other publications on marketing and farm supply cooperatives may be obtained upon request, while a supply is available from the

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